of the Pacific, or destroyed. When practicable, duplicate negatives have been made as a check against imperfections in the film.

The objective is of 5 inches aperture, but is stopped down to 3 inches, and the focal length is approximately 40 feet, giving an image of the Sun varying from $4\frac{3}{8}$ to $4\frac{9}{16}$ inches in size. The exposure is made by a shutter falling in front of the sensitive plate. This shutter has a horizontal slit with adjustable jaws, so that the width of the opening may be varied. In practice the correct exposure is gotten by using a width of the slit which varies from about $\frac{1}{4}$ inch in summer to $\frac{1}{2}$ inch in winter.

The length of the exposure varies from about $\frac{1}{400}$ second to $\frac{1}{200}$ second. The time at which the exposure is made, is gotten from a sounder in the dark room which gives the beats of the mean-time clock. These times are recorded to the nearest second. Very slow plates are used. C. D. PERRINE.

THE NEW STAR OF 1892.

By W. W. CAMPBELL.

We cannot doubt that all the stars are undergoing continual and progressive changes of condition. These changes are exceedingly slow and require long periods of time to become appreciable. In general, astronomers are not permitted to detect and record them. It is true that in the variable stars we observe rapid variations, both in brightness and in the appearance of their spectra; but so far as we know they occur in cycles. They repeat themselves and there are no evidences of permanent and progressive changes.*

The so-called "new stars" are in that respect an important exception. They change rapidly, both in brightness and physical condition, and in that fact lies their very great significance.

The interesting history of the new star in *Auriga* is well known. It appeared in December, 1891. Its spectrum was a very complex one, consisting of bright and dark lines and continuous

* There is some evidence of variations in brightness of a few stars during historic times, but there is no evidence of a change in their physical condition, such as would be indicated by a change in their spectra.

spectrum. The star became too faint to be seen with the 36-inch equatorial in April, 1892. It was re-discovered in August, 1892, when it was of the 10th magnitude. Its spectrum consisted of a few isolated bright lines superposed upon a very faint continuous spectrum. It was no longer the spectrum of a star; it was the spectrum of a nebula, and as such it has continued to the present time. However, some interesting and significant changes have occurred in the past year. The intensities of at least two of the prominent bright lines have decreased very materially. They are the lines at wave-lengths 436 and 575. The variations will be realized best if we tabulate, as below, the intensities of the most prominent six lines as estimated in 1892, and as estimated on three occasions in 1894.

		$H\gamma$	$\lambda 436$	$H\beta$	$\lambda 496$	$\lambda 501$	$\lambda 575$
1892.	Sept.	0.1	0.8	1	3	10	1
1894.	May 8.	0.1	0.3	1	3	10	0.4
1894.	Sept. 7.	0.1	0.2	1	3	10	0.4
1894.	Nov. 28.	0.1	0.1	1	3	10	0.3

It will be seen that the change in $\lambda 575$ is very decided and that the change in $\lambda 436$ is radical. The wave-lengths of both lines were observed in 1892 with comparative ease. They are now too faint for measurement. On the spectrum photographs taken early in September, 1892, the line $\lambda 436$ was by far the brightest line of all, *being certainly eight times as bright as* $H\gamma$. I have just secured another photograph of the spectrum (November 28), and it shows that $\lambda 436$ *is now fainter than* $H\gamma$. The intensities recorded in the above table show that the decrease has been gradual rather than sudden.

It is especially interesting that the lines $\lambda 436$ and $\lambda 575$ should be the ones to change. While the observations of the August, 1892, spectrum showed unmistakably that it was nebular, the lines $\lambda 436$ and $\lambda 575$ were not known to exist in the old nebulæ. However, photographs of nebular spectra soon showed the line $\lambda 436$ in five well-known nebulæ; and visual observations showed the line $\lambda 575$ in three well-known nebulæ. These lines were strong in the *Nova*, but relatively faint in the nebulæ. They have now become relatively faint in the *Nova!*

The spectra of the well-known nebulæ likewise have their anomalies. The lines $\lambda 447$ and $\lambda 469$, for instance, are very strong in some nebulæ, are very faint in others, and from some

appear to be entirely absent. The new star seems to be rapidly losing its anomalies: its spectrum is not only nebular, but it is approaching the *average type* of nebular spectrum.

Measures of the positions of the lines $\lambda 496$ and $\lambda 501$ on September 7, 1894, gave a velocity of approach of 27 kilometers (17 miles) per second. Similar measures on November 28 gave a velocity of approach of 13 kilometers (8 miles).

THE SUN'S MOTION IN SPACE.

By W. H. S. Monck.

That while there is a rough agreement between the various determinations of the Sun's motion in space, they differ considerably in details, is known to every one. I propose in this paper to endeavor to investigate the causes of these differences.

First, then, suppose we are seeking to determine the Sun's motion in space by means of stars with large proper motion, we must inquire what are the causes which produce larger proper motion in some stars than in others. These are: (1) Greater vicinity to us; (2) Greater actual velocity; (3) Motion nearly at right angles to the line of sight, so that there is but little foreshortening.

As regards the first of these causes, it is possible that the nearer stars have to a certain extent a common drift in space. If so, the Sun's goal relative to these stars will not be identical with his goal relative to the great mass of the stars. As regards the second and third causes, the stars which we are considering will probably be moving on the average with more than average velocity, both in Right Ascension and in Declination. This will not affect the position of the Sun's goal, but will diminish the effect of the Sun's motion on that of the stars and lead us to underrate the Sun's velocity.

But there is a fourth cause which has the contrary effect, viz: A star is more likely to have large proper motion when the effect of the Sun's motion is additive, than when it is subtractive. Stars with large proper motion may therefore be expected to have on the whole a drift in the opposite direction from the Sun's goal; which would lead us to overrate the velocity of the Sun's motion.